

What is claimed is:

1. A position detecting method for a head
being transferred to a radial direction of a
5 medium and recording and reproducing
information, characterized by comprising:

the step of recording a position
information signal pattern into the medium, the
position information signal pattern being
10 configured by arranging graphics surrounded by a
certain closed curve as pattern elements
uniformly on a plane, arranging the pattern
elements in circumferential and radial
directions of a disc so that a phase and a head
15 position establish a proportional relationship
in two or more frequency components of a
reproduced signal; and

the step of demodulating a position signal
of the head from the reproduced signal of the
20 position information signal pattern.

2. The position detecting method according
to claim 1, characterized in that the position
information signal pattern is recorded in a
25 manner that

the graphics surrounded the certain closed
curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial direction,

one arbitrary vector which is not parallel
5 with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to all the pattern elements arranged on the x axis
10 so as to be arranged uniformly on a recording plane,

the plane where the pattern elements are arranged is rotated through an arbitrary angle,

a portion for an arbitrary width determined
15 with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted axisymmetrically with respect to the x axis so
20 as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc, and their y axes match with the radial direction of the
25 disc.

3. The position detecting method according to claim 1, characterized in that the position information signal pattern is recorded in a manner that,

5 the graphics surrounded by the certain curve surface are used as the pattern elements, the pattern elements are arranged on the plane with constant intervals in an x axial direction,

10 one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to
15 all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

 when a size of the vector "a" is designated by "a", an angle formed by the vector "a" and
20 the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (k, l, m, n) which satisfies:

25
$$km \cdot a^2 + (kn + lm) \cdot ab \cdot \cos\theta + ln \cdot b^2 = 0$$

is determined, and α and β are obtained as follows:

$$\alpha = ka \cdot \cos\theta + lb$$

$$\beta = \sqrt{\{(ka)^2 + 2klab \cdot \cos\theta + (lb)^2\}},$$

when an y axial component of the vector (ka) is positive,

5 $\phi = \text{Arccos } (\alpha/\beta),$

when the y axial component of the vector (ka) is negative,

$$\phi = -\text{Arccos } (\alpha/\beta),$$

and the plane where the pattern elements are
10 arranged is rotated through the angle $-\phi$ in a state that a counterclockwise direction is the positive direction,

a portion for an arbitrary width determined with respect to the x axial direction is fetched
15 from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted axisymmetrically with respect to the x axis so as to be a second burst area,

20 the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc and their y axes match with the radial direction of the disc, and thus periodicity is provided to the
25 circumferential and radial directions simultaneously.

4. The position detecting method according to claim 1, characterized in that the position information signal pattern is recorded in a manner that,

the graphics surrounded by the certain closed curve are used as the pattern elements, the pattern elements are arranged on the plane with constant intervals in an x axial direction,

one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

when a size of the vector "a" is designated by "a", an angle formed by the vector "a" and the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (k, l) is determined, and α and β are obtained as follows:

$$\alpha = ka \cdot \cos\theta + lb$$

$$\beta = \sqrt{(ka)^2 + 2klab \cdot \cos\theta + (lb)^2},$$

when an y axial component of the vector (ka) is

positive,

$$\phi = \text{Arccos } (\alpha/\beta),$$

when the y axial component of the vector (ka) is negative,

5 $\phi = -\text{Arccos } (\alpha/\beta),$

and the plane where the pattern elements are arranged is rotated through the angle $-\phi$ in a state that a counterclockwise direction is the positive direction,

10 a portion for an arbitrary width determined with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted

15 axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc and their
20 y axes match with the radial direction of the disc, and thus periodicity is provided to the circumferential direction.

5. The position detecting method according
25 to claim 1, characterized in that the position information signal pattern is recorded in a manner that,

the graphics surrounded by the certain closed curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial
5 direction,

one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by
10 integral multiple of the vector with respect to all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

when a size of the vector "a" is designated
15 by a, an angle formed by the vector "a" and the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (m, n) is determined,
20 and α and β are obtained as follows:

$$\alpha = ma \cdot \cos\theta + nb$$

$$\beta = \sqrt{\{(ma)^2 + 2mnab \cdot \cos\theta + (nb)^2\}},$$

when an y axial component of the vector (ma) is positive,

$$25 \quad \phi = \text{Arccos} (\alpha/\beta) - 90^\circ,$$

when the y axial component of the vector (ma) is negative,

$$\phi = 90^\circ - \text{Arccos} (\alpha/\beta),$$

and the plane where the pattern elements are arranged is rotated through the angle $-\phi$ in a state that a counterclockwise direction is the
5 positive direction,

a portion for an arbitrary width determined with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

10 the first burst area is inverted axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the
15 circumferential direction of the disc and their y axes match with the radial direction of the disc, and thus periodicity is provided to the radial direction.

20 6. An information recording/reproducing device for transferring a head to a radial direction so as to record and reproduce information, characterized by comprising:

a position information signal pattern
25 recorded into a medium, the position information signal pattern configured by arranging graphics surrounded by a certain closed curve as pattern

elements uniformly on a plane and arranging the pattern elements in circumferential and radial directions of a disc so that a phase and a head position establish a proportional relationship in two or more frequency components of a reproduced signal; and

a position signal demodulating unit for demodulating a position signal of the head from the position information signal pattern.

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7. The information recording/reproducing device according to claim 6, characterized in that the position information signal pattern is recorded in a manner that,

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the graphics surrounded by the certain closed curve are used as the pattern elements, the pattern elements are arranged on the plane with constant intervals in an x axial direction,

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one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

25

when a size of the vector "a" is designated by "a", an angle formed by the vector "a" and the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (k, l, m, n) which satisfies:

$$km \cdot a^2 + (kn + lm) \cdot ab \cdot \cos\theta + ln \cdot b^2 = 0$$

is determined, and α and β are obtained as

10 follows:

$$\alpha = ka \cdot \cos\theta + lb$$

$$\beta = \sqrt{\{(ka)^2 + 2klab \cdot \cos\theta + (lb)^2\}},$$

when an y axial component of the vector (ka) is positive,

15 $\varphi = \text{Arccos } (\alpha/\beta),$

when the y axial component of the vector (ka) is negative,

$$\varphi = -\text{Arccos } (\alpha/\beta),$$

and the plane where the pattern elements are

20 arranged is rotated through the angle $-\varphi$ in a state that a counterclockwise direction is the positive direction,

a portion for an arbitrary width determined with respect to the x axial direction is fetched

25 from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted

axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc and their y axes match with the radial direction of the disc, and thus periodicity is provided to the circumferential and radial directions simultaneously.

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8. The information recording/reproducing device according to claim 6, characterized in that the position information signal pattern is recorded in a manner that,

15

the graphics surrounded the certain closed curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial direction,

20

one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

25

the plane where the pattern elements are arranged is rotated through an arbitrary angle, a portion for an arbitrary width determined with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc, and their y axes match with the radial direction of the disc.

9. The information recording/reproducing device according to claim 6, characterized in that the position information signal pattern is recorded in a manner that,

the graphics surrounded by the certain closed curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial direction,

one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a

position which is transferred in parallel by
 integral multiple of the vector with respect to
 all the pattern elements arranged on the x axis
 so as to be arranged uniformly on a recording
 5 plane,

when a size of the vector "a" is designated
 by "a", an angle formed by the vector "a" and
 the x axis is designated by θ , and an interval
 of the pattern elements in the x axial direction
 10 is designated by b, one of combinations of
 arbitrary integral numbers (k, l) is determined,
 and α and β are obtained as follows:

$$\alpha = ka \cdot \cos\theta + lb$$

$$\beta = \sqrt{\{(ka)^2 + 2klab \cdot \cos\theta + (lb)^2\}},$$

15 when an y axial component of the vector (ka) is
 positive,

$$\phi = \text{Arccos } (\alpha/\beta),$$

when the y axial component of the vector (ka) is
 negative,

20 $\phi = -\text{Arccos } (\alpha/\beta),$

and the plane where the pattern elements are
 arranged is rotated through the angle $-\phi$ in a
 state that a counterclockwise direction is the
 positive direction,

25 a portion for an arbitrary width determined
 with respect to the x axial direction is fetched
 from the plane where the pattern elements are

arranged, so as to be a first burst area,

the first burst area is inverted
axisymmetrically with respect to the x axis so
as to be a second burst area,

5 the first and second burst areas are
arranged so that their x axes match with the
circumferential direction of the disc and their
y axes match with the radial direction of the
disc, and thus periodicity is provided to the
10 circumferential direction.

10. The information recording/reproducing
device according to claim 6, characterized in
that the position information signal pattern is
15 recorded in a manner that,

the graphics surrounded by the certain
closed curve are used as the pattern elements,

the pattern elements are arranged on the
plane with constant intervals in an x axial
20 direction,

one arbitrary vector which is not parallel
with the x axial direction is determined, and
the pattern elements are further arranged on a
position which is transferred in parallel by
25 integral multiple of the vector with respect to
all the pattern elements arranged on the x axis
so as to be arranged uniformly on a recording

plane,

when a size of the vector "a" is designated by "a", an angle formed by the vector "a" and the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (m, n) is determined, and α and β are obtained as follows:

$$\alpha = ma \cdot \cos\theta + nb$$

$$\beta = \sqrt{\{(ma)^2 + 2mnab \cdot \cos\theta + (nb)^2\}},$$

when an y axial component of the vector (ma) is positive,

$$\phi = \text{Arccos } (\alpha/\beta) - 90^\circ,$$

when the y axial component of the vector (ma) is negative,

$$\phi = 90^\circ - \text{Arccos } (\alpha/\beta),$$

and the plane where the pattern elements are arranged is rotated through the angle $-\phi$ in a state that a counterclockwise direction is the positive direction,

a portion for an arbitrary width determined with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc and their y axes match with the radial direction of the disc, and thus periodicity is provided to the radial direction.

11. An information recording medium for transferring a head to a radial direction so as to record and reproduce information thereinto, characterized in that the information recording medium records a position information signal pattern, where graphics surrounded by a certain closed curve are arranged as pattern elements uniformly on a plane and the pattern elements are arranged in circumferential and radial directions of a disc so that a phase and a head position establish a proportional relationship in two or more frequency components of a reproduced signal, thereinto.

12. The information recording medium according to claim 11, characterized in that the position information signal pattern is recorded in a manner that

the graphics surrounded the certain closed curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial direction,

one arbitrary vector which is not parallel
5 with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to all the pattern elements arranged on the x axis
10 so as to be arranged uniformly on a recording plane,

the plane where the pattern elements are arranged is rotated through an arbitrary angle,

a portion for an arbitrary width determined
15 with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted axisymmetrically with respect to the x axis so
20 as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc, and their y axes match with the radial direction of the
25 disc.

13. The information recording medium according to claim 11, characterized in that the position information signal pattern is recorded in a manner that,

5 the graphics surrounded by the certain closed curve are used as the pattern elements, the pattern elements are arranged on the plane with constant intervals in an x axial direction,

10 one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to
15 all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

when a size of the vector "a" is designated by "a", an angle formed by the vector "a" and
20 the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (m, n) is determined, and α and β are obtained as follows:

25 $\alpha = ma \cdot \cos\theta + nb$

$$\beta = \sqrt{(ma)^2 + 2mnab \cdot \cos\theta + (nb)^2},$$

when an y axial component of the vector (ma) is

positive,

$$\phi = \text{Arccos} (\alpha/\beta) - 90^\circ,$$

when the y axial component of the vector (ma) is negative,

5 $\phi = 90^\circ - \text{Arccos} (\alpha/\beta),$

and the plane where the pattern elements are arranged is rotated through the angle $-\phi$ in a state that a counterclockwise direction is the positive direction,

10 a portion for an arbitrary width determined with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted

15 axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the circumferential direction of the disc and their
20 y axes match with the radial direction of the disc, and thus periodicity is provided to the radial direction.

14. The information recording medium
25 according to claim 11, characterized in that the position information signal pattern is recorded in a manner that,

the graphics surrounded by the certain closed curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial direction,

one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by integral multiple of the vector with respect to all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

when a size of the vector "a" is designated by "a", an angle formed by the vector "a" and the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (k, l, m, n) which satisfies:

$$km \cdot a^2 + (kn + lm) \cdot ab \cdot \cos\theta + ln \cdot b^2 = 0$$

is determined, and α and β are obtained as follows:

$$\alpha = ka \cdot \cos\theta + lb$$

$$\beta = \sqrt{\{(ka)^2 + 2klab \cdot \cos\theta + (lb)^2\}},$$

when an y axial component of the vector (ka) is positive,

$$\phi = \text{Arccos } (\alpha/\beta),$$

when the y axial component of the vector (ka) is negative,

$$\phi = -\text{Arccos } (\alpha/\beta),$$

5 and the plane where the pattern elements are arranged is rotated through the angle $-\phi$ in a state that a counterclockwise direction is the positive direction,

a portion for an arbitrary width determined
10 with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

the first burst area is inverted
axisymmetrically with respect to the x axis so
15 as to be a second burst area,

the first and second burst areas are
arranged so that their x axes match with the
circumferential direction of the disc and their
y axes match with the radial direction of the
20 disc, and thus periodicity is provided to the
circumferential and radial directions
simultaneously.

15. The information recording medium
25 according to claim 11, characterized in that the position information signal pattern is recorded in a manner that,

the graphics surrounded by the certain closed curve are used as the pattern elements,

the pattern elements are arranged on the plane with constant intervals in an x axial

5 direction,

one arbitrary vector which is not parallel with the x axial direction is determined, and the pattern elements are further arranged on a position which is transferred in parallel by
10 integral multiple of the vector with respect to all the pattern elements arranged on the x axis so as to be arranged uniformly on a recording plane,

when a size of the vector "a" is designated
15 by "a", an angle formed by the vector "a" and the x axis is designated by θ , and an interval of the pattern elements in the x axial direction is designated by b, one of combinations of arbitrary integral numbers (k, l) is determined,
20 and α and β are obtained as follows:

$$\alpha = ka \cdot \cos\theta + lb$$

$$\beta = \sqrt{\{(ka)^2 + 2klab \cdot \cos\theta + (lb)^2\}},$$

when an y axial component of the vector (ka) is positive,

25 $\varphi = \text{Arccos } (\alpha/\beta),$

when the y axial component of the vector (ka) is negative,

$$\varphi = -\text{Arccos } (\alpha/\beta),$$

and the plane where the pattern elements are arranged is rotated through the angle $-\varphi$ in a state that a counterclockwise direction is the
5 positive direction,

a portion for an arbitrary width determined with respect to the x axial direction is fetched from the plane where the pattern elements are arranged, so as to be a first burst area,

10 the first burst area is inverted axisymmetrically with respect to the x axis so as to be a second burst area,

the first and second burst areas are arranged so that their x axes match with the
15 circumferential direction of the disc and their y axes match with the radial direction of the disc, and thus periodicity is provided to the circumferential direction.